On Probability, Rules and Learning (Abstract)

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Abstract. Rules represent knowledge about the world that can be used for reasoning. However, the world is inherently uncertain, which may affect both rules and data. Indeed, rules capturing expert knowledge are only an approximation of a complex reality, and data may be uncertain due to missing values, noisy measurents, or ambiguities.

While a wide variety of formalisms and techniques exist to cope with uncertainty, the approach taken will be based on probabilistic (logic) programming [3]. More specifically, it shall be centered around the probabilistic Prolog, ProbLog [2] (see also http://dtai.cs.kuleuven.be/problog/), which extends the programming language Prolog with probabilistic facts and is based on Sato's distribution semantics [7]. It combines the deductive power of Prolog with the ability to state the belief that certain facts are true, very much as in probabilistic databases. As such it is a natural rule-based representation for dealing with uncertainty. ProbLog supports probabilistic inference, that is, it can compute the probability $P(Q|E)$ of a query Q given some evidence E [5].

It also supports learning. To learn parameters, it starts from examples that are partial interpretations (that is, partial descriptions of a possible world), and employs an Expectation-Maximisation approach [5]. ProbLog rules can be learned using a generalization of traditional rule-learning algorithms [4]. These rules are learned form uncertain data.

ProbLog has been applied to a number of applications in domains such as bioinformatics [1], action- and activity recognition [8] and robotics [6].

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